ANNUAL REPORT
TO THE NEW JERSEY PINELANDS COMMISSION

ALTERNATE DESIGN TREATMENT SYSTEMS PILOT PROGRAM

August 5, 2004

The Pinelands Commission

Background

The Federal and New Jersey Pinelands statutes call for the preservation, protection and enhancement of the unique Pinelands ecosystem and its land and water resources The exceptional quality of Pinelands water resources are protected and maintained through the control of development and other land uses and through close cooperation and coordination between local, state and federal agencies. To safeguard Pinelands water resources, the water quality provisions of the Pinelands Comprehensive Management Plan (CMP) focus on controlling the amount of nitrogen that enters the environment. Nitrogen is a significant point and nonpoint source pollutant due to its role in the eutrophication of surface water bodies. It is a useful indicator of overall Pinelands water quality and ecosystem health because it is naturally present in very low concentrations in the Pinelands environment.

The Commission's land use program discourages development in important ecological and agricultural areas while directing growth towards more suitable areas. While some of the designated growth areas are served by central sewer systems, others are not. In these unsewered growth areas, municipalities may zone for residential development on lots as small as one acre. One acre lots are also permitted in non-growth areas if certain cultural housing and grand fathered ownership conditions are met. In limited instances, waivers of strict compliance allow for development of unsewered dwellings on lots as small as 20,000 square feet.

The water quality standards of the CMP permit the use of on-site septic systems (individual subsurface sewage disposal systems) provided that the design of the system and the size of the parcel on which the system is located will ensure that the concentration of nitrogen in the ground water exiting the parcel or entering a surface water body will meet the Commission's water quality standard of two parts per million (ppm). The CMP utilizes the Pinelands Septic Dilution Model to calculate nitrogen loading to groundwater from septic systems and to confirm that proposed loadings do not exceed the assimilative capacity of the environment. When standard values for home occupancy, wastewater volume, wastewater strength and rainfall infiltration are used in solving the model, the model calculates that a minimum 3.2 acre parcel is required to dilute nitrogen to the required 2 ppm concentration when conventional septic system technology is used. Conventional septic system technology, typically consisting of a septic tank and effluent dispersal field (and sometimes a pump and dosing tank) is ineffective at removing or attenuating nitrogen levels in wastewater. Thus, unsewered residential development using standard (conventional) septic system technology is permitted only on minimum 3.2 acre parcels.

In order to comply with the Pinelands water quality standard, unsewered residential development on parcels smaller than 3.2 acres requires the use of advanced onsite denitrifying wastewater treatment technology. If the nitrogen concentration of the wastewater discharged from an on-site septic system is sufficiently reduced through the use of an advanced treatment system, the CMP allows the minimum lot size required to meet the 2 mg/l property line concentration to be reduced

from 3.2 acres down to a minimum of 1.0 acre.

The basic principals of biological nitrogen reduction in wastewater are well documented in the engineering literature In fact, biological nitrification and denitrification is now routinely employed at large centralized sewage treatment plants, especially those that discharge treated effluent to environmentally sensitive receiving waters. These large scale treatment facilities have the advantage of professionally trained and licensed operators and have the ability to enhance nitrogen removal through the use of chemical feed equipment and to make real time process modifications in response to changing influent wastewater characteristics.

The use of biological denitrification technologies at the much smaller scale of individual onsite systems is a relatively recent development. The US EPA as well as number of individual States and regions have developed and are currently administering programs to study the effectiveness of onsite wastewater denitrification treatment technologies. The Ad Hoc Committee On Alternative Septic Systems, convened by the Pinelands Commission in March 2000, conducted a thorough review of this ongoing work to evaluate alternate treatment technologies nationwide, consulted with officials from other state and university programs involved with advanced on-site septic system technologies and management strategies, retained a consultant to assess the technical performance of selected technologies, met with treatment system manufacturers and county health officials, and coordinated research efforts with the New Jersey Department of Environmental Protection (DEP). After completing this extensive research, the Committee recommended the establishment a CMP pilot program to test five specific onsite wastewater treatment systems. The Alternative Design Wastewater Treatment Systems Pilot Program contained in the CMP (N.J.A.C. 7:50-10.21) is authorized as a means to test whether these systems can be maintained and operated so as to meet the water quality standards contained in the CMP with maintenance requirements that a homeowner can be reasonably be expected to follow.

Significant dates pertaining to the pilot program are as follows:

August 5, 2002	Effective date of the pilot program; residential applications received after this date for lots less than 3.2 acres that are not served by public sewer are required to use a Pinelands alternate design wastewater treatment system. Completed applications received prior to this date may use a pressure dosing septic system, subject to additional time constraints.
January 10, 2003	Copies of sample ordinances provided to Pinelands area municipalities with correspondence requesting timely municipal adoption.
July 5, 2003	Start of semi-annual reporting requirement for each manufacturer of an alternate technology treatment system to submit to the Executive Director a report which includes the number of systems installed during the previous six months and since the beginning of the pilot program, a discussion of

	any installation problems and what has been done to address those problems, an analysis and evaluation of the monitoring results to date and a discussion of any operational or maintenance issues, including the number of systems requiring maintenance or repairs and the nature and success of such maintenance and repairs, and the number of times the automatic dialing alarm system was set off and the reasons for each such occurrence.
August 5, 2003	For completed applications received prior to August 5, 2002, last day to obtain design plan approval from a local/county health department for a pressure dosing septic system.
August 5, 2004	Last day to complete the installation of a pressure dosing septic system for those plans approved prior to August 5, 2003.
August 5, 2006	Executive Director is to review the pilot program and report to the Commission within three months of this date on the implementation of the program. This report is to address nitrogen removal efficiencies of the treatment technologies, maintenance requirements, cost, frequency of system problems, an evaluation of the number of systems installed and a determination as to the adequacy of that number to render a final determination on the effectiveness of the treatment technologies in meeting the purposes and objectives of the State and Federal Pinelands Acts.
August 5, 2007	Last day to install a Pinelands alternate design wastewater treatment system unless a rule has been adopted which expressly authorizes such installations. (Note: Systems installed on or prior to this date will be subject to the three year wastewater monitoring requirement, through August 5, 2010, and the five year warranty, and five year service contract, through August 5, 2012).

Introduction

Amendments to the CMP establishing the Pinelands Alternate Design Wastewater Treatment System Pilot Program became effective on August 5, 2002. The rule requires that the Executive Director submit an annual report to the Commission describing activity to date on the installation, maintenance and performance data for each alternate design wastewater treatment technology. This second annual report is submitted to fulfill the annual reporting requirement to the Commission on the status of the Pinelands Pilot Program for Alternate Design Wastewater Treatment Systems.

Before any of the five alternative technology systems may be used within the Pinelands, the

manufacturer of the alternate design treatment system must submit and the Executive Director must approve detailed engineering design plans and system specifications, details on the automatic alarm dialing system, a wastewater sampling protocol, an operation and maintenance manual, a sample five year warranty, a sample five year operation and maintenance contract, and a sample deed notice.

Use of the alternative onsite wastewater treatment systems are authorized only in those municipalities which have adopted an ordinance that provides for the use of such systems and where the ordinance has been certified by the Commission.

The CMP also requires that each technology manufacturer or its agent submit a semi-annual report to the Executive Director which includes information on the number of systems installed, a discussion on the installation of systems, an analysis and evaluation of wastewater monitoring results to date, and a discussion of any operational or maintenance issues experienced .

Summary of Program Activity

Alternative systems are authorized for use only in those municipalities which have adopted an ordinance to implement the pilot program. Those ordinances must then be certified by the Commission pursuant to N.J.A.C. 7:50-3. To assist the municipalities in this process, pilot program ordinances have been developed by the Land Use and Technology Office and were provided to the 40 Pinelands municipalities in which alternative systems could be used based upon existing zoning. To date, implementing ordinances have been adopted by 31 municipalities and the Commission has certified 30 of those with certification pending for the thirty-first. Several additional municipalities have indicated their intention to introduce and adopt the ordinance.

Commission staff is continuing to work on ordinance adoption with the remaining, non-adopting Pinelands municipalities. Several of the municipalities that have not adopted an implementing ordinance have cited a desire to restrict residential development from occurring on lots smaller than 3.2 acres, even though existing zoning allows for such development. The Commission is aware of one case in which a potential developer of one such parcel has indicated his intention to litigate the municipality's failure to adopt the pilot program. Commission staff, in consultation with the Commission's Deputy Attorney General is evaluating potential solutions to the municipal non-adoption issue.

The following provides the status of municipal ordinance adoption as of August 4, 2004:

Municipal Ordinances for Alternate Design Treatment System Pilot Program

Certified	*Adopted*	*No Adopted Ordinance Yet*
Barnegat	Shamong	Berkeley
Bass River		Egg Harbor City
Berlin Township		Egg Harbor Township
Buena Borough		Evesham (to be adopted 8/17)
Buena Vista		Little Egg Harbor
Chesilhurst		Monroe
Dennis		Plumsted
Estell Manor		Port Republic (introduced)
Folsom		Southampton
Franklin		
Galloway		
Hamilton		
Hammonton		
Jackson		
Lacey		
Manchester		
Maurice River		
Medford		
Mullica		
Ocean		
Pemberton		
Stafford		
Tabernacle		
Upper		
Washington		
Waterford		
Weymouth		
Winslow		
Woodbine		
Woodland		

The NJDEP has actively participated in the development of the Commission's pilot program. To expedite the approval of the Pinelands pilot program alternate design septic systems, NJDEP has issued a Generic Treatment Works Approval (TWA) Permit which allows the use of the five

Pinelands pilot program systems without individual applicants being subject to the standard $450 NJDEP permit fee or 90 day review period. The expedited NJDEP Generic TWA Permit has been well received by both the regulatory and development community. It has proven to be an effective instrument allowing individual applications to be approved directly by the Pinelands county health departments bringing significant time and expense savings to the applicants.

To further facilitate implementation of the pilot program and to assist the engineering community in the preparation and submission of treatment system design plans, Commission staff conducted a one day seminar in January 2004 at the Atlantic Cape Community College in Mays Landing. The seminar, entitled "Designing a Pinelands Alternative Wastewater Treatment System" was attended by over 100 engineers, state, county, and municipal officials. Seminar presenters included NJDEP and Pinelands staff, and representatives of each of the five pilot program technology manufacturers. We continue to coordinate with the Pinelands county health departments to facilitate the transition from the county health officials review and approval of pressure dosing septic systems to the five pilot program alternate designs. Additionally, Commission staff is routinely providing guidance to the consulting engineering community to assist the engineers in complying with the requirements of the pilot program.

The CMP (N.J.A.C. 7:50-10.22(a)5.) requires the Executive Director to submit an annual report describing installation, maintenance and performance data for each treatment technology. However, because the CMP allows for pressure dosing systems to be constructed until August 5, 2004, only seven Pinelands alternate design treatment systems have been installed to date, with the first system coming online in April, 2004. This report will summarize information pertaining to the installation of these seven systems. Because the pilot program permits the alternative systems to undergo a three month start-up and stabilization period to allow microbial populations to develop, there are no effluent monitoring results to report on at this time.

For summary purposes, the five Pinelands alternate design pilot program systems are:

1. Ashco RFS ^{III}
2. Amphidrome
3. Bioclere
4. Cromaglass
5. FAST

In accordance with the provisions of the pilot program requirements, prior to being certified for use, the manufacturer of each alternate design treatment system is required to submit specific documents to the Executive Director for review and approval.

Ashco-A-Corporation has provided the required documentation and based upon a detailed review by Commission staff, the Executive Director approved the Ashco RFS ^{III} Gravity system effective May 15, 2003 and the Ashco RFS ^{III} Gravity Dosing system effective July 24, 2003. Based upon

the Pinelands Septic Dilution Model, the pilot program provides that each Ashco RFS ^{III} system shall be located on a parcel containing at least 1.5 acres for each dwelling unit that will be served by the system.

F.R Mahony & Associates, the manufacturer of the Amphidrome system has provided the required documentation and based upon a detailed review by Commission staff, the Executive Director approved the single family Amphidrome system effective July 24, 2003. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each Amphidrome system shall be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Aquapoint, Inc., the manufacturer of the Bioclere system has provided the required documentation and based upon a detailed review by Commission staff, the Executive Director approved the single family Bioclere system effective November 18, 2003. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each Bioclere system shall be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Cromaglass, Inc., the manufacturer of the Cromaglass system has provided the required documentation and based upon a detailed review by Commission staff, the Executive Director approved the Cromaglass system effective December 29, 2004. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each Cromaglass system shall be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Bio-Microbics, Inc., the manufacturer of the FAST system has provided much of the required documentation which is currently in an early stage of review by Commission staff. It is anticipated that the Executive Director may approve the FAST system in the fall of 2004. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each FAST system shall be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Commission staff has actively sought to increase public and governmental awareness and acceptance of advanced onsite wastewater treatment technologies as a means of controlling nonpoint source pollution. During the current annual reporting period, informational presentations on the pilot program were given by staff to the N.J. State League of Municipalities , the Pinelands Newly Elected Officials, the N.J. Environmental Health Association and the Pinelands Municipal Council.

Installation Summary

The first Pinelands alternative wastewater treatment system was installed on March 11, 2004 and brought online on April 20, 2004. The manufacturer of that system, F.R. Mahony & Associates,

agreed to use this installation as a training opportunity for representatives of the Pinelands area health departments. Training in the operation and installation of the Amphidrome system was provided by two engineers and two field service technicians from F.R. Mahony Associates. Many of the Pinelands area health departments (and several non-Pinelands area health departments) participated in this field training exercise.

A total of seven Pinelands alternative wastewater treatment systems have been installed and granted construction approvals to date. These systems, all Amphidromes (sequencing batch reactors), were given final construction approval during the period of May 7, 2004 through July 29, 2004. Five of the systems are located in Hamilton Township, Atlantic County and two are located in Tabernacle Township, Burlington County.

Prior to any Pinelands alternative treatment system being issued a final operational approval, the Pinelands area health departments and the Pinelands Commission must receive an executed five year maintenance contract, five year warranty, three year wastewater sample and analysis protocol, deed notice, as-built plan and construction certification from the technology manufacturer and the NJ licensed engineer of record. These documents have been received for each of the systems approved during this reporting period.

Although as of this date only Amphidrome systems are installed and operational, engineering plans which propose the use of Ashco RFS ^{III}, Bioclere, and Cromaglass treatment systems have all been approved by the Pinelands area health departments and are pending installation.

The manufacturer of the Amphidrome system, F.R. Mahony Associates reported that during the installation and start-up of one of the Amphidrome systems, a minor problem was detected with the operation of the process blower and wiring to the blower. The problem was immediately identified and corrected and the system is reported to be functioning as designed. There were no other installation problems reported relative to the remaining six Amphidrome systems installed during the subject reporting period.

Each system supplied by F.R. Mahony is supplied with an automatic alarm dialer which is programmed during startup to dial F.R. Mahony representatives trained in emergency situations. In addition, the dialers are programed to make weekly "well call' notifications to the alarm responders to confirm satisfactory alarm and operation. There has been one alarm condition to date that resulted in the automatic dialer calling into the system manufacturer, F.R. Mahony. F.R. Mahony reports that the alarm call was received by three different alarm responders, one primary and two backups. In response to the alarm condition, the homeowner was immediately contacted and requested to identify which indicator light was active on the control panel and was then requested to silence the alarm. An F.R. Mahony service technician was in the area and was dispatched to the system location where it was determined that the alarm was caused by a float switch that had become hung up within the Amphidrome reactor. The technician reset the float switch in a manner that would prevent future entanglements.

Cost Summary

An integral component of the pilot program is the monitoring by the Commission of treatment system costs. To facilitate the Commission's monitoring of these costs, the CMP requires the manufacturer of the treatment technologies to report on the cost of installation of each individual system.

It should be noted that the total cost of an onsite wastewater treatment system consists of at least three separate costs, those being the cost of the alternative treatment unit and 5 year service package, the cost of the soil absorption system and the cost of engineering services. The manufacturers of the treatment technologies have direct knowledge of the cost of their equipment and related support services, which in the case of the Pinelands pilot program includes a five year maintenance contract, five year warranty, and three years of quarterly effluent analysis. The manufacturers however do not have direct involvement in the installation of the soil absorption field, or the local engineering of the system including soil testing, design services, as-built plans, etc..

To aid the Commission in monitoring the full cost of the Amphidrome alternate design systems, F.R. Mahony Associates has developed a Contractor Post Installation Questionnaire in which the home builder is asked to provide costs for these ancillary components and services. This has enabled the Commission to identify the cost of the treatment technology (and the technology manufacturers support services) and the cost of engineering, soil absorption field installation, etc.

The following summary of Amphidrome system costs is based upon information provided to the Commission by F.R Mahony, Associates, as supplemented by local home builders. It should be noted that costs may come down over time for a number of reasons. Prior experience with pressure dosing systems was such that as engineers and installers became more familiar with pressure dosing technology after it's original introduction in N.J. in the late 1980's, both design and installation costs decreased. NJDEP has indicated that a reduction in the minimum required soil absorption field size has scientific merit due to the high quality effluent produced by these systems and that future revisions to the State's septic design standards may incorporate reduced field sizes. In addition it is noted that the cost information provided herein is representative only of the Amphidrome system which may have the highest overall cost of the four treatment technologies approved to date. Lastly, future costs of replacing failed soil absorption fields may be saved in entirety as a result of the approximately 98 % removal of total suspended solids and biochemical oxygen demand that accounts for premature failure of absorption fields receiving only primary treated wastewater.

Name of Treatment System Technology	No. of Systems Evaluated for this Report	Average Reported Cost per Treatment Unit and 5 year service package *	Average Reported Cost for Engineering, Soil Absorption Field Installation, etc. **	Average Reported Overall Cost of the Advanced Onsite Treatment Systems
Amphidrome	7	$ 18,172	$ 12,619	$ 30,791

***** Cost of the Amphidrome Treatment Unit as sold by F.R. Mahony, Associates including hardware and equipment, 5 year annual maintenance contract, 5 year warranty, 3 years quarterly effluent analysis, annual pumping of 2000 gallon anoxic tank for 5 years, and delivery of equipment to job site is $ 14,355. In addition, the average cost of concrete tankage (2000 gal. concrete anoxic tank, concrete reactor vessel and 1000 gal. concrete clearwell), purchased separately from local suppliers, including delivery to the job site, is $ 3,817.

****** Costs include determination of soil and site suitability (soil logs and "perc" tests), preparation of engineering plans, completion of NJDEP standard application forms, excavation for soil absorption system and tank placement, soil absorption system materials (suitable "K4" replacement soil, stone filter materials and lateral piping, or gravel free chambers, geotextile fabric), installation of all components, electrical connections, surveyor services, as-built plans, engineering construction observation and engineering certifications.

Treatment System Nitrogen Attenuation Summary

As discussed previously, there are no effluent sample results available at this time due to the system installations dates and the ninety day start-up, stabilization period that precedes sample collection and analysis.

Home occupancy, water use and cleaning and laundry product usage may vary greatly from one residence to another. These and other variables can markedly impact the concentration of nitrogen in wastewater and can adversely affect the ability of a treatment system to meet established discharge limits. High occupancy within a dwelling can result in abnormally high levels of nitrogen in wastewater given that each person contributes approximately 9 lbs. of nitrogen to the system annually. Water conservation, while certainly desirable, has the potential to result in high concentrations of pollutants in the wastewater because there is less water available to dilute the pollutants. Excessive use of certain cleaning and laundry products can stress the bacteria that provide biological nitrification and denitrification. Because of this, education of system users is an important component of any wastewater management program.

In recognition of these factors, all of the alternative treatment system vendors have developed homeowner user manuals which provide critical information to the owners of the alternative treatment systems. In addition, F.R. Mahony Associates has developed a questionnaire which they've provided to the users of the Amphidrome system which is aimed at identifying laundry and

cleaning product usage and any other condition which might lead to non-compliant sample results. Staff will recommend that all of the technology vendors collect and analyze this type of information to better understand user characteristics and to enhance compliance with effluent discharge limits.

Next Steps

Commission Staff will continue to work with Biomicrobics, the manufacturer of the FAST system, toward attaining the requisite certification of the system for participation in the pilot program.

Further, in an effort to expand the number of treatment system choices available to Pinelands residential applicants, staff will continue to research similar technologies and may return to the Commission in the future to recommend new rule making to allow the introduction of additional technologies to the pilot program. Several alternative systems are undergoing evaluation in other technology demonstration projects and preliminary results indicate that some of these systems, if used on appropriately sized lots, may also meet the water requirements of the CMP. A likely benefit to introducing additional proven technologies may be lower system costs resulting from increased competition among the approved technology vendors.

As the treatment technology monitoring data becomes available, staff hopes to be provide public access to the validated data through the Commission's web site. This should enable potential users an opportunity to make better informed decisions in choosing a particular treatment system.

Staff will continue to inform the regulated community and other interested parties of the benefits of the use and management of advanced onsite wastewater treatment technologies. Coordination with the Pinelands area health departments, municipal officials, design professionals, the building community, and environmental groups will be ongoing. A third annual seminar is currently being planned.

The existing pilot program is limited to residential development because the Pinelands Ad Hoc Septic System Committee determined that insufficient data was available to establish specific nitrogen removal efficiencies for the highly variable characteristics of non-residential (commercial and institutional) wastewater. The CMP allows non-residential applicants to propose to use an advanced treatment system in lieu of dilution based upon parcel size only on a case by case basis. Many of our Pinelands towns and villages could benefit from the use of alternative treatment technologies by commercial establishments. Although we remain ready to assist municipalities explore the use of "community" systems to serve multiple residential and commercial buildings, the Commission may wish at some future point to authorize advanced technologies for individual commercial uses as part of a closely monitored pilot program.

All advanced treatment systems require a higher level of maintenance to achieve optimum

treatment efficiencies as compared to standard septic systems. Because of this, the CMP specifies that municipalities will be encouraged to allow community treatment systems to be installed in larger residential developments where densities between one and 3.2 acres are currently authorized. However, experience indicates that developers are frequently disinclined to propose a community treatment system because of delays in acquiring the necessary wastewater management plan amendments. Greater use of community treatment systems might be achieved if an expedited process for wastewater management plan amendments in the Pinelands could be developed.

The necessity of periodic maintenance of onsite wastewater treatment systems, both conventional and alternative, is well documented yet lack of regular maintenance remains the a major cause of premature system failure. The CMP (N.J.A.C. 7:6.85(a)) has long required that owners of every onsite septic system in the Pinelands have the system inspected by a technician at least every three years, have the system cleaned at least every three years and once every three years, submit to the board of health serving the municipality in which the system is located a sworn statement that the facility has been inspected, cleaned and is functional, setting forth the name of the person who performed the inspection and cleaning and the date of the inspection. While the goal of this requirement is well founded, compliance is virtually non-existent. A lack of resources to administer and enforce this rule at the local level is likely the primary reason for its failure to take hold.

One of the greatest challenges to meeting the water quality standards of the CMP will be the development of a long term program to address the continued approval, use and maintenance of advanced onsite treatment technologies. To achieve this goal, a long term septic system management program must commence prior to the conclusion of this five year pilot program. By the conclusion of the pilot program (August 5, 2007) , we must have responsible management entities in place, established through appropriate institutional arrangements. Only through such a program can we ensure the long-term maintenance and monitoring of the alternative technologies. In the absence of a septic system management program, the ability to permit unsewered residential development on lots between one and three acres may be jeopardized. Absent a meaningful management program, rezoning of these parcels would likely be necessary. Moreover, the management of existing conventional systems, as currently required in the CMP would also be addressed as would the development of a much needed septic system Best Management Practices Manual. We have submitted a grant proposal to the Department of Environmental Protection and NJDEP's Division of Watershed Management has expressed an interest in possibly funding this septic system management initiative.